

Claims

[c1] **What is claimed is:**

1. A vortex tube cooling system, comprising:
a housing adapted for subsurface disposal, the housing containing:
a first pressure chamber;
a vortex tube coupled to the first pressure chamber;
a cooling chamber coupled to the vortex tube; and
a second pressure chamber coupled to the cooling chamber;
wherein the pressure chambers are adapted to stimulate a cool fluid flow from the vortex tube into the cooling chamber.

[c2] 2. The system of claim 1, wherein the first pressure chamber is adapted for pressurization and the second pressure chamber is adapted for evacuation.

[c3] 3. The system of claim 1, the housing further comprising a third pressure chamber coupled between the first pressure chamber and the vortex tube, the third chamber adapted to sustain a predetermined fluid pressure for input to the vortex tube.

- [c4] 4. The system of claim 1, the housing further comprising a heat exchanger coupled between the second pressure chamber and the vortex tube, the exchanger adapted to receive hot fluid flow from the vortex tube.
- [c5] 5. The system of claim 1, the housing further comprising a compressor adapted to pump a fluid from the second pressure chamber into the first pressure chamber.
- [c6] 6. The system of claim 5, the housing further comprising: a third pressure chamber coupled between the cooling chamber and the second pressure chamber; and a second compressor adapted to pump a fluid from the third chamber into the second chamber.
- [c7] 7. The system of claim 1, wherein the cooling chamber is double walled and adapted to allow fluid flow from the vortex tube through a space between the walls.
- [c8] 8. The system of claim 1, wherein the housing is adapted for disposal within a borehole traversing a subsurface formation while drilling the borehole.
- [c9] 9. The system of claim 1, wherein the housing is adapted for disposal within a borehole traversing a subsurface formation via a wireline cable.
- [c10] 10. The system of claim 1, further comprising a plurality

of valves linked between the first, second, and cooling chambers to regulate fluid flow through the chambers.

- [c11] 11. The system of claim 1, wherein the cooling chamber is adapted to house an electronic component.
- [c12] 12. The system of claim 1, wherein the exterior of the first pressure chamber, second pressure chamber, or cooling chamber is covered by an insulating material.
- [c13] 13. The system of claim 1, wherein the first pressure chamber, second pressure chamber, or cooling chamber is disposed within a Dewar flask.
- [c14] 14. A vortex tube cooling system, comprising:
 - a housing adapted for subsurface disposal, the housing containing:
 - a first pressure chamber adapted to sustain high fluid pressure;
 - a vortex tube coupled to the first pressure chamber;
 - a cooling chamber coupled to the vortex tube;
 - a second pressure chamber coupled to the cooling chamber and adapted to sustain lower fluid pressure in relation to the first pressure chamber;
 - at least one valve linked between the first pressure chamber and the cooling chamber to regulate fluid flow to stimulate a cool fluid flow from the vortex tube into

the cooling chamber.

- [c15] 15. The system of claim 14, wherein the cooling chamber is double walled and adapted to allow fluid flow from the vortex tube through a space between the walls.
- [c16] 16. The system of claim 14, the housing further comprising a compressor adapted to pump a fluid from the second pressure chamber into the first pressure chamber.
- [c17] 17. The system of claim 16, the housing further comprising a third pressure chamber coupled between the first pressure chamber and the vortex tube, the third chamber adapted to sustain a predetermined fluid pressure for input to the vortex tube.
- [c18] 18. The system of claim 16, the housing further comprising a heat exchanger coupled between the second pressure chamber and the vortex tube, the exchanger adapted to receive hot fluid flow from the vortex tube.
- [c19] 19. The system of claim 16, the housing further comprising:
 - a third pressure chamber coupled between the cooling chamber and the second pressure chamber; and
 - a second compressor adapted to pump a fluid from the third chamber into the second chamber.

- [c20] 20.The system of claim 14, wherein the housing is adapted for disposal within a borehole traversing a subsurface formation while drilling the borehole.
- [c21] 21.The system of claim 14, wherein the housing is adapted for disposal within a borehole traversing a subsurface formation via a wireline cable.
- [c22] 22.The system of claim 16, further comprising a plurality of valves linked between the first, second, and cooling chambers to regulate fluid flow through the chambers.
- [c23] 23.The system of claim 14, wherein the cooling chamber is adapted to house an electronic component.
- [c24] 24.The system of claim 14, wherein the exterior of the first pressure chamber, second pressure chamber, or cooling chamber is covered by an insulating material.
- [c25] 25.The system of claim 14, wherein the first pressure chamber, second pressure chamber, or cooling chamber is disposed within a Dewar flask.
- [c26] 26.A method for cooling a component within a housing adapted for subsurface disposal, comprising:
 - a)equipping the housing with:
 - a first pressure chamber;
 - a vortex tube coupled to the first pressure chamber;

a cooling chamber coupled to the vortex tube;
a second pressure chamber coupled to the cooling chamber;
b) disposing the component to be cooled within the cooling chamber; and
c) adapting the pressure chambers to stimulate a cool fluid flow from the vortex tube into the cooling chamber.

- [c27] 27. The method of claim 26, wherein step (c) comprises pressurizing the first pressure chamber and evacuating the second pressure chamber.
- [c28] 28. The method of claim 26, wherein step (c) comprises pumping a fluid from the second pressure chamber into the first pressure chamber.
- [c29] 29. The method of claim 26, further comprising equipping the housing with a heat exchanger coupled to the vortex tube to receive hot fluid flow from the vortex tube.
- [c30] 30. The method of claim 26, further comprising equipping the housing with a third pressure chamber coupled between the cooling chamber and the second pressure chamber, and pumping a fluid from the third chamber into the second chamber.
- [c31] 31. The method of claim 26, wherein the cooling chamber

ber is double walled and adapted to allow fluid flow from the vortex tube through a space between the walls.

- [c32] 32. The method of claim 26, further comprising disposing the housing within a borehole traversing a subsurface formation while drilling the borehole.
- [c33] 33. The method of claim 26, further comprising disposing the housing within a borehole traversing a subsurface formation via a wireline cable.
- [c34] 34. The method of claim 26, further comprising equipping the housing with a plurality of valves linked between the first, second, and cooling chambers to regulate fluid flow through the chambers.
- [c35] 35. The method of claim 26, wherein the component to be cooled is an electronic component.
- [c36] 36. The method of claim 26, wherein the exterior of the first pressure chamber, second pressure chamber, or cooling chamber is covered by an insulating material.
- [c37] 37. The method of claim 26, wherein the first pressure chamber, second pressure chamber, or cooling chamber is disposed within a Dewar flask.